

What is Metascientific Ontology?

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RESUME — L'ontologie métascientifique se distingue des ontologies philosophiques par ses objectifs, ses objets et ses méthodes. Par un examen des théories ontologiques de Mario Bunge, nous montrerons que leur principal objectif est l'élaboration d'une représentation unifiée du monde tel que connu via les sciences, que leurs objets d'étude sont les concepts scientifiques, et que leurs méthodes ne diffèrent pas de celles qu'on s'attend à trouver dans toute activité rationnelle. L'ontologie métascientifique n'est donc pas transcendante parce qu'elle ne cherche pas à représenter des objets étrangers au monde que nous habitons et aux sciences qui l'étudient, et par conséquent elle n'a pas besoin de facultés ni de méthodes spéciales pour mener à bien ses recherches. L'ontologie métascientifique est un discours général scientifique sur le monde parce que conçue par et pour les sciences.

ABSTRACT — Metascientific ontology differs from philosophical ontologies in its objectives, objects and methods. By an examination of the ontological theories of Mario Bunge, we will show their main objective is a unified representation of the world as known through the sciences, their objects of study are scientific concepts, and their methods do not differ from those that one expects to find in any rational activity. Metascientific ontology is therefore not transcendent because it does not seek to represent objects alien to the world we inhabit and to the sciences that study it, and therefore does not need special faculties and methods to carry out its research. Metascientific ontology is a general scientific discourse on the world because it was designed by and for the sciences.

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We continue our characterization of metascience that we have undertaken in our article *Metascience. For a Scientific General Discourse* (Maurice 2020). In order to better understand the nature of metascience, and thus to better understand what distinguishes it from philosophy, we will compare metascientific ontology to philosophical ontology. Since we argue in the just-mentioned article that Bunge's philosophical theories are in fact metascientific theories, we will use Bunge's ontology to make this comparison.

We will therefore examine the ontological theories as set out in Bunge's writings, particularly those found in volumes 3 and 4 of the *Treatise on Basic Philosophy*. This presentation will clearly highlight the non-philosophical nature of Bunge's theories, notably by his refusal to postulate the existence of objects or entities other than those postulated and studied by science and his rejection of philosophical methods.

In several texts Bunge has attempted to define or characterize metaphysics or scientific ontology². In general, Bunge considers that ontology and metaphysics are synonymous, just as scientific ontology and scientific metaphysics are synonymous, although Bunge leans towards the use of the second expression before 1977 and for the use of the first since 1977. It should be noted, however, that we should not confuse *scientific ontology* as characterized by Bunge or by other philosophers with *metascientific ontology* as we will characterize it from Bunge's practice, although in the end, that is, once we no longer refer to Bunge's conceptions or those of philosophers, we consider the two expressions to be synonymous. In fact, if we refer to a strictly metascientific framework, we can speak of ontology only. In the end, what interests us is to succeed in showing that

² Bunge's five main texts that deal with the nature of scientific ontology are: an article with the explicit title "Is Scientific Metaphysics Possible?", 1971, chapter two of *Method, Model and Matter* entitled "Testability Today", 1973, a text in French entitled "Les présupposés et les produits métaphysiques de la science et de la technique contemporaines", 1974, an article that proposes a typology of scientific theories entitled "The GST Challenge to the Classical Philosophies of Science", 1977, and the introduction of *Ontology: The Furniture of the World*, volume 3 of the *Treatise on Basic Philosophy*, 1977.

scientific or metascientific ontology as we conceive it differs from any *philosophical ontology*.

As scientific ontology, *scientific metaphysics* is used not only by Bunge but also by some philosophers. For our purposes, let us only note that we have re-defined metaphysics as the metascience of physics, in the same way that there is metachemistry, metabiology and metapsychonology³. For us, ontology and metaphysics are not synonymous, although this is for reasons different from those advanced by philosophers who see a difference between ontology and metascience.

Finally, the expression *scientific philosophy* is a contradiction in terms. Our appreciation of philosophy as a *transcendent general discourse* does not allow it to be scientific (Maurice 2020). The non-scientificity of philosophy will become clearer once Bunge's metascientific ontology is exposed as an illustration of a scientific general discourse.

In this article, we are interested in the objects of study (referents) of the ontological theories exposed in volumes 3 and 4 of the *Treatise*. We therefore leave aside the form these theories can take or their formalism, the use that can be made of them or their implementation, and how these theories can be evaluated or their testability. We will also leave aside the Bungean thesis according to which abstract scientific theories, such as Lagrangian dynamics, and systems theories, such as cybernetics or the theory of automata, are ontological theories. In particular, Bunge argues that there is no boundary between factual science and ontology, that there is a continuity that runs from the most particular factual sciences to the most general ontologies: "A complete ontology should include both *universal* and *regional* ontological theories. The former serve as frameworks for the latter, which will in turn illustrate and in a way test the former." (Bunge 1977, 3:11). Thus, in philosophical jargon, Bunge argues for a form of naturalization of ontology. We will not examine this thesis of the continuity between factual science and ontology, but our results rather indicate a dichotomy between the two disciplinary fields. Note that Bunge does not defend the idea of continuity between factual science and mathematics. On the contrary, he postulates a dichotomy between factual proposition and formal proposition. In addition to the referents of ontological theories, we will focus on the methods, techniques and tools used by Bunge to build these theories. We will then see that

³ We group under psychonology all the disciplines that deal with humans on the basis of the existence of a fourth level of organization of matter, thinking matter, in the same way that there is a physical, chemical and living matter (Maurice 2020).

Bunge does not appeal to any approach associated with philosophical doctrines. In short, we will follow Bunge's advice:

When in doubt about the authenticity of an intellectual endeavor, the right thing to do is to perform a candorous (*sic*) reexamination of its three components: subject matter, method, and goal. (Bunge 1973, 1)

In the case which interests us, i.e. the nature of Bungean ontology, we will examine the ontological theories set out in volumes 3 and 4 of the *Treatise* devoted to their development: *Ontology I: The Furniture of the World* and *Ontology II: A World of Systems*. Specifically, for the task ahead, we need to look only at chapters 3 to 6 of *Ontology I* and Chapter 1 of *Ontology II*. Why this restriction of our field of investigation? Our aim is to show 1) that the Bungean ontology does not postulate the existence of any particular object, but takes for granted the existence of the objects studied by the factual sciences, and 2) that the methods, techniques and cognitive faculties used to achieve this are those that one would expect to find in all rational activities, be it scientific research, management, law, etc. The chapters mentioned above expose the fundamental concept of Bungean ontology, the *concrete object*⁴. In fact, the Bunge system is designed to account for the concrete object in the light of science. Whether it is semantics, epistemology, methodology or ontology, it is always the concrete object that is discussed because factual sciences study only concrete objects. If an examination of the central concept of Bungean thought reveals no transcendence, it is implausible to find it in any other places in Bunge's work.

We can divide these two volumes into six distinct moments. Chapters 1 and 2 of *Ontology I* serve to introduce the notions of *substantial individual* and *substantial property* respectively. These concepts are used in Chapter 3 to define the concepts of *concrete object* and *totality of concrete objects* (Sect. 1.1). Chapter 3 also puts forward two postulates, the ontological one of the *existence of concrete objects* (section 1.2) and the methodological one of the *dichotomy between concrete and conceptual objects* (section 1.3). Once these two definitions and these two postulates are in place, Bunge is able to introduce a large number of ontological notions (while appealing to semantic, epistemological and methodological considerations), which goes from section 1.4 of chapter 3 up to Chapter 6, the

⁴ See in this issue Martín Orensanz's article, *Bunge and Harman on the General Theory of Objects*, for the general notion of object, and not just that of concrete object. See also in this issue the article by Lukyanenko, Storey and Pastor, *Foundations of Information Technology Based on Bunge's Systemist Philosophy of Reality*, for a defense of the idea that the notion of concrete system is increasingly replacing that of concrete object in Bunge's writings following the *Treatise*.

last chapter of *Ontology I*. In Chapter 1 of *Ontology II*, the very first definition is that of a *concrete system*, defined using the notion of concrete object, just as for the ontological concepts of *Ontology I*. Subsequently, and from the second definition, it is this notion of concrete system which takes center stage, and which will play as important a role in *Ontology II* as the role played by the notion of concrete object in *Ontology I*. Chapters 2 to 5 of *Ontology II* are then devoted to the study of concrete chemical, biological, psychological, and social systems⁵. Finally, chapter 6, the last chapter of *Ontology II*, generalizes some results concerning concrete systems.

1 GOALS OF ONTOLOGY

Bunge has stated the objectives of ontology in several places and these objectives are diverse because they relate to certain theses as to the nature of ontology which we briefly discussed in the introduction⁶. For our purpose, which is to show that Bunge's general discourse is not philosophical, we restrict our study to the main objectives that remain even if we reject the thesis of the continuity between science and ontology. If we stick to the introduction of *Ontology I* of the *Treatise*, we find the following objectives of interest to us:

[...] the ontologist should stake out the main traits of the real world as known through science, and that he should proceed in a clear and systematic way. He should recognize, analyze and interrelate those concepts enabling him to produce a unified picture of reality. (The word "reality" is here understood in a strict and non-Platonic sense, namely as the concrete world.) (Bunge 1977, 3:5)

We take factual (natural or social) science and ontology to be the only disciplines concerned with concrete objects. And we assign ontology the task of constructing the most general theories concerning such and only such objects. (Bunge 1977, 3:6)

⁵ In other words, Bunge offers some elements of ontology of what we have called metachemistry, metabiology, metapsychology and metasociology (there is also semantics, epistemology and methodology of metachemistry, etc.) (Maurice 2020). There is no chapter on physical systems (a chapter of metaphysics in the metascientific sense) in *Ontology II* because, according to Bunge, they are the best known of all and he covered these systems in *Ontology I* (Bunge 1977, 3:45). Technically, Bunge's second claim is wrong since he dealt with the notion of concrete object in *Ontology I* and not that of physical system.

⁶ See note 2 for a list of Bunge's texts discussing the nature of ontology.

If we summarize, ontology produces general theories of concrete objects by studying and generalizing the characteristics of these objects as known to science in order to arrive at a unified conception of reality⁷. These general traits or ontological categories are, for example, those of property, law, possibility and change.

The objectives of Bungean ontology thus stated include in filigree the objects of study as well as the legitimate methods of this ontology. The notion of concrete object is at the heart of Bungean ontology. It is this notion that will be the subject of a theorization developed in *Ontology I*. Almost all ontological notions relate to the concrete object. But the definitions and assumptions concerning the concrete object are fed by the knowledge of the concrete objects studied by the physical, chemical, biological, psychological and sociological sciences. There is therefore a back-and-forth between scientific results or constructs, which are analysed and interpreted, and the construction or synthesis of the concrete object. Thus, the study of scientific results, and not the concrete objects themselves, justifies conceiving metascience as distinct from factual sciences and made up of conceptual sciences, forming a triad with factual sciences and formal sciences (Maurice 2020).

We will therefore examine in more detail in the next two sections the objects of study and the methods of Bungean ontology.

2 OBJECTS OF ONTOLOGY

The notion of concrete or material object of chapter 3 of *Ontology I* is defined in a formal and complex way. Bunge needs a theory of substance (Chapter 1) and a theory of form (Chapter 2) to arrive at a definition of the concrete object. We will not examine these two theories and adopt a more intuitive characterization of the concrete object proposed by Bunge himself, which will suffice for our purposes (Bunge 1977, 3:240; 2000). The concrete object is the object susceptible of change. But since change is impossible without energy or without a transfer of energy, the concrete object is the object endowed with energy. This definition justifies the postulate, still in chapter 3 of *Ontology I*, of the dichotomy between concrete objects (things) and conceptual objects (constructs). Concepts,

⁷ Even if for Bunge the ultimate outcome of any research is a theory, a hypothetico-deductive system, he is aware that many of the results presented in *Ontology I* and *II* are not strictly speaking theories. He therefore introduces the notion of ontological framework, a construct which is situated between a set of ideas that are not very closely related to each other and a hypothetico-deductive system, i.e. a theory (Bunge 1977, 3:11–12).

propositions, theories and formal objects of logic and mathematics are not endowed with energy, are therefore not susceptible to change, and therefore have no concrete, material or real existence.

It should be noted that the definition of a concept is not proof of the existence of the object to which the concept refers. Thus, in Chapter 3 of *Ontology I*, we saw that there is the definition of the concrete object, but also the postulate of the existence of concrete objects⁸. Thus, Bunge takes for granted the existence of concrete objects although he theorizes about them. Moreover, for Bunge, the criteria and demonstrations of the existence of particular concrete objects such as atoms, living cells or social groups are not a matter of ontology but of factual sciences (we will come back to this later). Bunge therefore does not attempt, in *Ontology I: The Furniture of the World*, to determine the “furniture of the world” if by furniture of the world we mean the particular objects studied by the factual sciences:

What is there?—we shall abstain from answering it. That is, we shall not list the kinds of constituent of the world but shall leave the task to the special sciences. For, no sooner does the metaphysician pronounce the world to be “made of” such and such kinds, than the scientist discovers either that some of the alleged species are empty or that others are missing in the metaphysician’s list. (Bunge 1977, 3:153)

We can, however, understand “furniture of the world” in a general sense. At this time, conceptual objects to which ontological concepts refer are seen as the furniture of the world. But, in the world there are no general concrete objects, no general properties or laws, no general states or events, no general processes or changes. All that exists are particular objects, endowed with their particular properties, in particular nomic interaction: “The real thing is the substantial individual with all its intrinsic and mutual properties. Everything else is fiction.” (Bunge 1977, 3:101). Or, in a lapidary fashion: “To be, to exist really, is to be a thing.” (Bunge 1977, 3:158). Or:

[...] *all* things, and *only* things, possess the property of existing really—a property represented by E_{θ} . This vindicates Aristotle’s principle that *real existence is singular*. There are no general things: every real existent is an individual. (Therefore “general systems theory” is a misnomer for “general theory of systems”.) Whatever is general is either a property (e.g. a law) or

⁸ Likewise, change (Bunge 1977, 3:261) and energy (Bunge 1977, 3:240) as phenomena are taken for granted, although these notions are theorized in Chapter 5 of *Ontology I*.

an attribute (in which case it may be called a universal) or a proposition or a set of propositions (e.g. a theory). (Bunge 1977, 3:157; italics in the original)

We construct a general concept of the notion of concrete object, property, state, event, process, and change. Without these general concepts, often used implicitly, any theorization, even in the factual sciences, would be impossible. It is for this reason that there are metascientific concepts inherent in science mistakenly equated with philosophical concepts. In other words, we need general concepts to represent the world to us and to communicate, but these concepts do not refer to particular real objects; they are the result of abstraction and generalization.

Thus, Bunge postulates the existence of concrete objects and puts forward several reasons to justify such an assumption, of which here is one:

Another reason for having to postulate the existence of things is that, if we want to prove anything about existents, we must posit them. We cannot prove the existence of concrete things any more than we can prove the existence of deities or of disembodied minds. What can be proved is that, unless there were things, other items—such as acting on them and investigating them—would be impossible. (Bunge 1977, 3:112)

A demonstration or logical proof of existence is impossible. It is through reflection, experience, and knowledge that we can convince ourselves of the existence of the world and the concrete objects that form it. And much of this reflection, experience and knowledge are fueled by science. More precisely, we cannot demonstrate the existence of the general concrete object because it does not exist. Only the existence of a particular concrete object postulated by the factual sciences can be the subject of empirical proof (in fact, it suffices to find only one):

Our theory of things supplies no criterion for either establishing or refuting any hypothesis to the effect that such and such an object really exists. It is not the business of metaphysics to offer existence criteria [...]. (Bunge 1977, 3:160)

Or,

Metaphysics, on the other hand, is hardly in a position to admit or rule out any fact. What metaphysics can do is to clarify some of the concepts

involved in scientific judgments of possibility or impossibility. (Bunge 1977, 3:178)

Thus, an essential notion in Bunge is that of a *concrete object* or *thing*. Concrete objects are objects susceptible to change because they are endowed with energy. In contrast, we find *conceptual objects* or *constructs*. These are not subject to change because they do not have energy. Are we then in the presence of an ontological duality? No, since one of the axioms of the Bungean system is that only concrete objects exist. The duality is therefore methodological and indeed necessary to allow us to treat fictions or constructs *as if* these constructs were autonomous. But this necessary methodological duality is often perceived by the mind as an ontological duality (Maurice 2020).

Among concrete objects, we have, for example, objects commonly considered concrete, such as a stone, but also objects whose concreteness is not immediately apparent, such as a quantum object, a physical field, a simple substance, a chemical compound, a living organism, a family, a business. Thus, the meaning of “concrete” in Bunge has a much broader scope than that of common sense or even that of philosophy. Again, anything that has energy, and therefore susceptible to change, is a concrete object.

Among the conceptual objects, there are objects of logic and mathematics, but also any construct which refers to concrete objects or represents them, whether this construct has a well-defined logical or mathematical form. Thus, functions and mathematical sets are constructs, but also the concept of metabolism, which should not be confused with the concrete metabolism to which it refers.

This dichotomy between factual and formal object led Bunge to propose a theory of factual properties and natural classes because predicates of logic cannot be equated with concrete properties and mathematical sets cannot be confused with natural classes:

We now have a theory of properties, distinct from the theory of predicates, and a theory of kinds, different from the algebra of sets. We can therefore use without qualms the concepts of a property and a kind. The differences between predicates and properties, and between sets and kinds, suffice to ruin the ontological interpretations of logic and of set theory. There is no reason to expect that pure mathematics is capable of disclosing, without further ado, the structure of reality. (Bunge 1977, 3:150)

Just as a mathematized physical theory cannot be assimilated to a mathematical theory, a mathematized ontological theory cannot be assimilated to a logical or mathematical theory. Logic and mathematics have no ontological scope in metascience. Only some philosophical, religious, and mystical doctrines give formal sciences the power to account for the world without worrying about the factual sciences.

Once Bunge is in possession of the notion of concrete object, much of the postulates and definitions of his ontology are constructed using this notion. Here is a partial list of these concepts: state, state space, nomic statement, natural class, population, community and species, real existence, nothingness, real possibility and necessity, disposition and propensity, change, event, process, space-time, concrete system, level of organization. Thus, all these ontological concepts are based on the notion of concrete object.

For example, it is not uncommon for a definition to start with "Let X be a thing. ...", or "If $T \subseteq \Theta$ is a set of concrete objects, then..." (Θ being the set of all concrete objects). Take for example definition 4.3 of *fact*:

Let X be a thing. Then f is a *fact* involving X iff either

i) f is a *state* of X , i.e. there is a state space $S_{\mathbb{L}}(X)$ for X such that $f = s \in S_{\mathbb{L}}(X)$, or

ii) f is a *change of state* of (or *event* in) X , i.e. there is an $S_{\mathbb{L}}(X)$ such that $f = e = \langle s, s' \rangle \in S_{\mathbb{L}}(X) \times S_{\mathbb{L}}(X)$ (Bunge 1977, 3:169)

In other words, "a (real) fact is either the being of a thing in a given state, or an event occurring in a thing" (Bunge 1977, 3:267). The notions of state and change of state in point i) and ii) are defined in a similar way using the general notion of a thing or concrete object. Examination of the other ontological notions on which Bunge dwells only confirms the latter's interest in the concrete object. But not just any concrete object since the general notion of thing is supposed to conform to more specific notions produced by the sciences, such as those of physical field, atom, cell, person, society, etc. Bunge can be said to be interested in the *scientific object* if we understand that this expression means the *scientific study of concrete objects*, which are the same for scientists and everyone else. Bunge is not interested in how we conceive the concrete object in everyday life, although factual sciences such as psychology or sociology may be interested in it. Common sense is not intended primarily to produce objective knowledge, whereas it is this objective knowledge, produced by the factual sciences, which

deserves to be studied in general. In other words, common knowledge cannot be the subject of a general discourse because its concepts are not objective enough or coherent enough and therefore cannot be generalized, while the objectivity of scientific knowledge makes possible the existence of a scientific general discourse.

When we look at the definitions and assumptions of *Ontology I* and *II*, Bunge's ontology, unlike philosophical ontologies, is not intended to reveal a reality to which the factual sciences would not have access. Not only does Bunge not assert the existence of any conceptual, ideal or spiritual object, but it does not even assert the existence of any concrete objects. It is the factual sciences that postulate the existence of concrete objects, establish criteria for their existence, and develop ways to study them.

3 METHODS OF ONTOLOGY

Bunge has hardly discussed his method of constructing semantic, ontological, and epistemological theories, perhaps because for the author of the *Treatise* it is obvious that there are no special faculties or special tools for theorizing science. Bunge draws on the entire arsenal of cognitive faculties, starting with reflection⁹, and does not a priori favor a mathematical formalism based on a philosophical doctrine. Discussing the nature of the philosophy of science, its object, method, and purpose, he argues:

The object should be real science (both natural and social), and the method should be essentially the same as the method of science—since in either case one tries to know something given. The goal should be to dismount and then to reassemble the mechanism of science in order to expose its structure, content, and functions. (Bunge 1973, 21)

And more particularly in the case of ontology:

Any means should be permitted in constructing a metaphysical theory as long as it leads to a good theory: pinching from another field, analogizing, extrapolating, looking for models of abstract theories, and of course inventing radically new ones. Here, as in science and in mathematics, there is no

⁹ Ordinary or natural reflection, with which we are all endowed, and not philosophical reflection. Thinking, even in general, does not prove that we are philosophizing (Maurice 2020).

royal road, and theories are judged by their works not by their scaffoldings.
(Bunge 1971, 509)

Thus, in terms of methods and techniques of analysis, Bunge practices methodological conservatism and opportunism. Many philosophers, including Bunge, make little or no use of the tools or methods of reflection and analysis recognized by philosophers. These methods seem to cause more problems than they solve, which may be why they are not used in formal and factual science. Here is therefore a non-exhaustive list of tools, methods and approaches, mainly associated with philosophical doctrines and of which Bunge does not make use¹⁰: philosophical counterfactualty, philosophical thought experiment, philosophical logical analysis, philosophical conceptual analysis, philosophical linguistic analysis, philosophical necessity and possibility, philosophical conceivability, philosophical intuition, dialectics, epoché, etc¹¹.

Throughout his work Bunge has consistently criticized these approaches or methods and has always denied the existence of special cognitive faculties necessary for philosophical practice. It would be pointless to seek *the* Bungean method, as it is customary for the great philosophers, the method then coming to characterize the philosopher. In this way, a Platonist cannot surpass Plato, a Cartesian cannot surpass Descartes and a Kantian cannot surpass Kant. The method is inseparable from the philosopher. If you change the method a little too much, you develop another philosophical doctrine. In Bunge's case, a general discourse about the world does not require a particular approach different from what is practiced in any rational activity, whether in science, management, law, education, health, etc. (Maurice 2020)

So we do not find in Bunge, for example, a distinction between what is ontologically, metaphysically or philosophically possible and what is factually, concretely, materially, really or physically possible. Necessity and metaphysical possibility do not exist in Bunge, which implies that he does not resort to philosophical methods to establish what would be philosophically or

¹⁰ We have to qualify most of the approaches listed as philosophical because most of them also have a non-philosophical meaning.

¹¹ For an overview of philosophical methods, see the *Oxford Handbook of Philosophical Methodology* (Capellen, Gendler, and Hawthorne 2016) and the *Cambridge Companion to Philosophical Methodology* (Overgaard and D'Oro 2017).

metaphysically necessary or possible¹². This situation alone should convince anyone that Bunge's ontological theories are not a matter of philosophy but of metascience.

Cordero clearly noted the fundamental aspect of the Bungean approach: all rational activity uses experience, reason, imagination and criticism (Cordero 2019, 94–96). Note that the experience, reason, and imagination in question have no transcendent significance. In other words, it is about the experience of the concrete world, including and especially the concrete world revealed by the factual sciences, and of the use of reason and the imagination as natural faculties and not as faculties which would give us access to a philosophical reality.

4 CONCLUSION

To understand the distinction between metascience and philosophy it is useful to remember that we do not have direct access to reality, that there is no evidence or general demonstration of the existence of things, that we must then take for granted the existence of the “external world”, that there is no possible answer to the question of the existence of one property rather than another. It is through reflection and experience that we arrive at this conclusion (Maurice 2020).

Our representation of the world therefore involves the study of scientific results, which is the task of metascientific ontology. If we further believe that a general discourse on science is valid, useful for the advancement of knowledge, then we study science itself, which is devolved to metascientific semantics, epistemology, and methodology.

Bungean ontology therefore does not postulate the existence of any object and does not use any philosophical method. If a discipline is characterized by its objects and methods, then Bunge's scientific ontology bears little resemblance to philosophical ontologies. Bunge does not problematize science the way philosophers do. In philosophical jargon, Bunge is a materialist, but his materialism boils down to accepting concrete objects studied by the physical, chemical, biological and psychonological sciences. He therefore relies on science to determine the furniture of the world. It is therefore abusive to reduce Bunge's thought to a

¹² Bunge distinguishes conceptual possibilities from real or factual possibilities, in accordance with his methodological postulate of the dichotomy between concrete and conceptual objects. These notions of possibility are discussed in Chapter 4 of *Ontology I*. It suffices to mention that the real possibilities depend on the laws of nature, that is to say on the nomic relations that exist between properties.

materialist doctrine insofar as even these doctrines, because they are philosophical, postulate the existence of objects and processes foreign to science and use methods unknown to scientists. We don't need materialist doctrines, we just need to adopt the same general postulates as the sciences, analyze and interpret their results, then abstract and generalize, all with the help of our natural faculties. The role of Bungean ontology, but also of semantics, epistemology and methodology, is similar to that of metalogic and metamathematics. And since the scientific beast is just as complex as the logical beast or the mathematical beast, it is not surprising that Bunge had to compose a treatise of nearly 2,400 pages to lay the foundations of metascience¹³.

Bunge tells us in his autobiography that he had set himself the goal of linking philosophy and science. In doing so he annihilated philosophy to produce a scientific general discourse. This general discourse is designed for science and for scientists, more precisely for metascientists, i.e., scientists interested in a general discourse on the world and science. It is easy for any scientist interested in a general discourse about science and about the world to understand Bunge's thought. Nothing he says is extravagant and nothing he does get off the track of a normal research process. Because he summed up the spirit of the Bungean approach so well, let's leave the final word to Joseph Agassi:

The idea behind the [Bungean] program is as commonsense as could be. This may sound disappointing, as it lacks all extravagance, but then this is what the program is all about. The idea is to stay well within one world [...]. (Agassi 1990, 117)

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¹³ We exclude here Volume 8 of the *Treatise* dealing with ethics because for us metascience, a scientific general discourse, is dissociated from a general discourse of convivence or the living-together. There is no metascientific imperialism as there is a philosophical imperialism (Maurice 2020).

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